

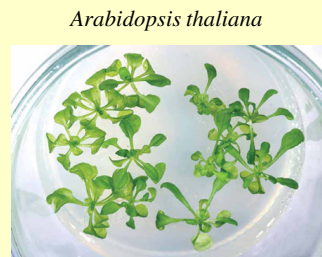


Interdomain competition: *Arabidopsis thaliana* versus Soil Bacteria

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Growth Conditions

- 16 hours of light
- Ambient temperature
 - Cool 18-20°C
 - Warm 24-26°C
- 3 Replicates (10 seeds/plate) per treatment (10 treatments)

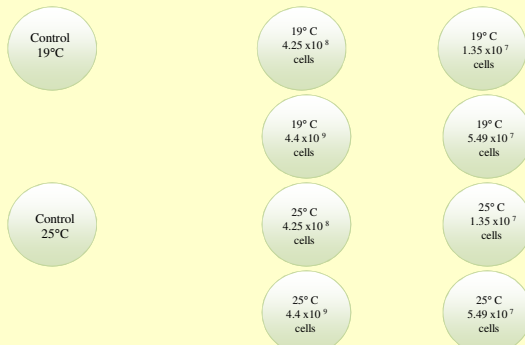


Arabidopsis thaliana

Experimental Design

- Set up competitive conditions
- Determine concentrations of bacterial cultures using optical density. Inoculate plates with bacterial cultures, incubate 24 hours. Inoculate plates with seeds of *Arabidopsis thaliana* and incubate 10 days.
- Monitor plant growth
- Plates were checked daily for 10 days to evaluate germination and growth of *A. thaliana*.
- Verify survival of bacteria
- After 7 days, swabs of the dishes were incubated in nutrient broth and checked for bacterial growth.
- Change conditions to enhance bacterial growth
- A layer of nutrient broth was added to aid in bacterial growth. Plant growth was again monitored.

Only *Arabidopsis thaliana* *Pseudomonas aeruginosa* *Bacillus subtilis*



Abstract

Plants in their natural habits are constantly competing with other organisms. *Arabidopsis thaliana* is a model plant that must germinate and grow in the presence of common soil bacteria such as *Pseudomonas aeruginosa* and *Bacillus subtilis*. *A. thaliana* may compete with soil bacteria such as for water, micronutrients, and the carbohydrate produced by photosynthesis. If there is competition between plants and soil bacteria, conditions that favor the growth of microorganisms will negatively impact plant development.

A. thaliana was grown in petri dishes inoculated with *Pseudomonas aeruginosa* and *Bacillus subtilis*. Murashige and Skoog agar, a plant growth media, was used initially, to favor plant growth. The experiment was done in both warm conditions, that favor bacteria, and cool conditions, that discourage bacterial growth, and at high and low concentrations of bacteria. Later in the experiment, the growth of *P. aeruginosa* and *B. subtilis* was enhanced by adding nutrient broth to the petri dishes.

We found that, under these conditions, the plants are only vulnerable to bacterial competition at the earliest stages, and only with low concentration of *B. subtilis* under warm conditions. Bacterial growth later in plant development actually seems to promote plant growth.

Hypothesis

Arabidopsis thaliana competes with soil bacteria such as *Pseudomonas aeruginosa* and *Bacillus subtilis* for water, micronutrients, and carbohydrate.

Conditions that favor the growth of microorganisms will negatively impact plant development.

“What counts is not necessarily the size of the dog in the fight; it’s the size of the fight in the dog”

Dwight D. Eisenhower (1890-1969) Thirty-Fourth President of the USA

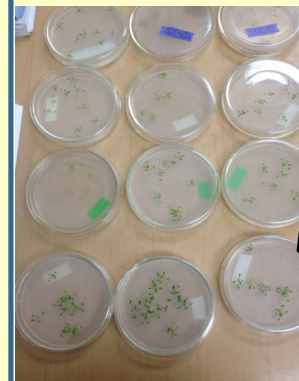
Future Research

- Labeling and tracking the growth of individual seeds as they developed.
- Increasing competition at an early stage by adding nutrients broth earlier in the experiment to enhance the growth of the bacteria.
- Testing to determine if cells life stage affects their ability to compete
- Enhancing aseptic techniques such as, parafilming each Petri dish to avoid contamination.



Contamination due to Mold

Cold Chamber

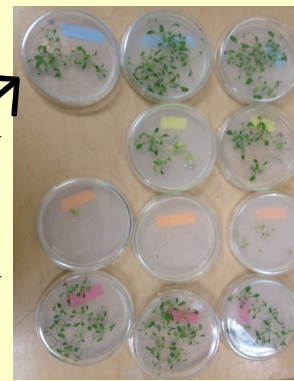


Results

Low concentrations of *P. aeruginosa* showed the fastest growth.

Low concentrations of *B. subtilis* showed the slowest growth.
(p=0.0107, ANOVA)

Hot Chamber



High *B. subtilis*
Low *B. subtilis*
High *P. aeruginosa*
Low *P. aeruginosa*

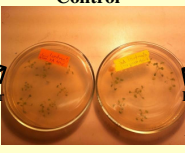
Lack of growth in Low *B. subtilis*

Low concentration *P. aeruginosa*

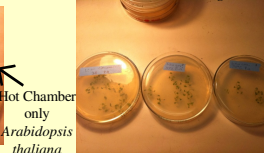


Cold Chamber only
Arabidopsis thaliana

Control



Low concentration *P. aeruginosa*



Hot Chamber only
Arabidopsis thaliana

Conclusions



Competition between plant, bacteria, and algae

- *Bacillus subtilis* seems to compete with *Arabidopsis thaliana* seedlings under limited conditions, such as when seedlings are very young.
- Age of the *B. subtilis* culture may be important in determining whether the bacterial cells will compete with the seedlings.
- *A. thaliana* had a **higher** germination rate in the presence of *Pseudomonas aeruginosa* under low concentration levels.